

## **A solar signal in lower stratospheric water vapour?**

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A merged time series of stratospheric water vapour built from HALOE and MIPAS data between 60°S and 60°N and 15 to 30 km and covering the years 1992 to 2012 was analysed by multivariate linear regression including an 11-year solar cycle proxy. Lower stratospheric water vapour was found to reveal a phase-shifted anti-correlation with the solar cycle, with lowest water vapour after solar maximum. The phase shift is composed of an inherent constant time lag of about 2 years and a second component following the stratospheric age of air. The amplitudes of the water vapour response are largest close to the tropical tropopause (up to 0.35 ppmv) and decrease with altitude and latitude. Including the solar cycle proxy in the regression results in linear trends of water vapour being negative over the full altitude/latitude range, while without the solar proxy positive water vapour trends in the lowermost stratosphere were found. We conclude from these results that a solar signal generated at the tropical tropopause is imprinted on the stratospheric water vapour abundances and transported to higher altitudes and latitudes via the Brewer-Dobson circulation. Hence it is concluded that the tropical tropopause temperature at the final dehydration point of air is also governed to some degree by the solar cycle. The negative water vapour trends obtained when considering the solar cycle impact on water vapour abundances can solve the water vapour conundrum of increasing stratospheric water vapour abundances at constant or even decreasing tropopause temperatures.

### **References**

Schieferdecker, T., Lossow, S., Stiller, G. P., and von Clarmann, T., *Atmospheric Chemistry & Physics Discussion*, **2015**, 15, 12353 - 12387.